THE JOURNAL OF THE CANADIAN ASSOCIATION OF RADIOLOGISTS

Volume VI | December 1955 | Number 4

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Subscription: $2.00 per annum

Publication Manager—Gwendolyn A. Mollison

Medical Secretarial Service Reg'd.

Suite 305, 1555 Summerhill Avenue — Montreal 25, Quebec, Canada.

THE JOURNAL OF THE
CANADIAN ASSOCIATION OF RADIOLOGISTS

Volume VI December 1955 Number 4

OSTEOPETROSIS — REPORT OF THREE CASES

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Arthabaska, Que.

Since the original publication of Albers-Schoenberg in 1904 on "marble bone" disease, many authors have reported similar cases with different nomenclature, such as: generalized osteosclerosis, chalky bones, "maladie des os d'ivoire," essential osteopetrosis, osteosclerosis fragilis generalisata.

Three other cases of this uncommon disease are presented.

Case I

An eleven-year-old boy was first admitted to the hospital in April 1948 for a suspected fracture of the right leg. Besides a fracture, the radiogram revealed an extensive sclerosis of almost all the parts of the skeleton.

Roentgenological Findings:

1) Skull.

The bones of the calvarium are very thick and dense; the sella turcica is made narrow by the abnormal thickness of the clinoid processes. The paranasal sinuses are opaque and the cellular structure of both mastoids is lost. The facial area is disproportionately small in comparison with the skull. The mandible, which is hypoplastic, retains its normal structure, whereas the hyoid bone is involved. (Fig. 1 & 2).

2) Spine.

All the vertebral bodies and ribs show increased density (Figs. 3, 4).

3) Pelvis.

Transverse lamellar striations give a striped pattern to the iliac wings. Both hips show a varus deformity. The sacrum and upper femora are also involved (Figs. 5, 6).

4) Extremities.

Besides the marked sclerosis of the bone extremities, there is an abnormal enlargement with a clubbing deformity. In addition, there are slightly transparent striations, parallel to the periosteum, and transverse bands of increased density, clearly seen at the inferior portion of the femora and superior portion of the tibiae. A peculiar sign appears in the phalangeal epiphysis of the two first toes and in some of the fingers, vertical transparent lines at the center of the epiphysis. Numerous old fractures are seen, illustrating the osseous fragility. (Figs. 7, 8, 9, 9A, 9B, 10, 11, 12).

Family History:

The parents are living and well. A sister, 18 years old, present a similar disease.

This boy had a fracture of the left forearm at eight years of age, and at the time of his first hospitalization, a fracture of the right leg. The left eye vision is decreased and there is a moderate deafness.

Laboratory Data:

No anemia. Phosphates: 4.25 (normal 1 to 3). Alkaline phosphatase: 0.65 (normal 2 to 4). Urine normal and Kahn negative.

In November 1952, the patient was hospitalized for infectious arthritis of the left knee.

The radiogram revealed that the osteosclerotic involvement was more pronounced and the deformities more marked than four years before. Anemia was present: Hemoglobin 9.3 — 60%. R.B.C.: 3,800,000. Calcium, phosphates and alkaline phosphatases were normal.

Case II

An elder sister of the patient in Case I presents the same disease, and in a more advanced stage.

At the age of 4, after having fractured her right leg, she became unable to walk. The legs are atrophied and show extreme deformities. A film of the right leg is included. (Fig. 13).

An old fracture of the humerus never concolidated. Hearing is normal but there is almost complete loss of sight. The sclerosis of the vertebrae, clavicle, scapula and ribs is more pronounced than is her brother's. A transparent striation is seen at the epiphysis of the terminal phalanx of the big toe. (Fig. 15). Bony changes in the skull and extremities were similar to those of Case I.

Case III

On November 2nd, 1954, an eleven-year-old girl was admitted for pneumonia. The chest X-ray showed a pneumonic consolidation in the left lung, and at the same time, an abnormal density of the ribs (Fig 17). Further examination of the skeleton revealed the following findings.

The vertebral bodies of the thoracic and lumbar spine are reel shaped with a wide vascular channel (Figs. 18, 19, 20). The epiphyseal plates are uniformly condensed, whereas the intermediate zone has a normal density except for an opaque nodule in the middle.

The clavicles, sternum, ribs and pelvis are involved but the skull is normal. The iliac bones show a pattern of alternating bands of increased density (Fig. 21). In the upper portions of the humerus, the cancellar area is thick and dense and the medulla is partially obliterated. Transverse bands of increased density are visible at both extremities of radius and ulna near the epiphyseal line, and also in the long bones of the hands. The upper portions of the tibiae are dense and widened, with narrowing of the marrow cavity. (Fig. 22).

Family History:

There is no known similar disease in the other members of the family.

Clinical Findings:

The girl is intelligent, undersized and slightly anemic. The spleen and liver are not palpable. She had a fracture of the left humerus at the age of 9.

Laboratory Data:

Tests of the urine and blood — serum, calcium, phosphorus, alkaline phosphatase, total protein, serum globulin and albumin, all gave normal results.

Comments:

We have dealt with three cases of osteopetrosis, having all the characteristics of this disease:

1) Extensive sclerosis of all bones.
2) Widening and club-shaped deformity of the ends of the bones.
3) Narrowing of the medulla.

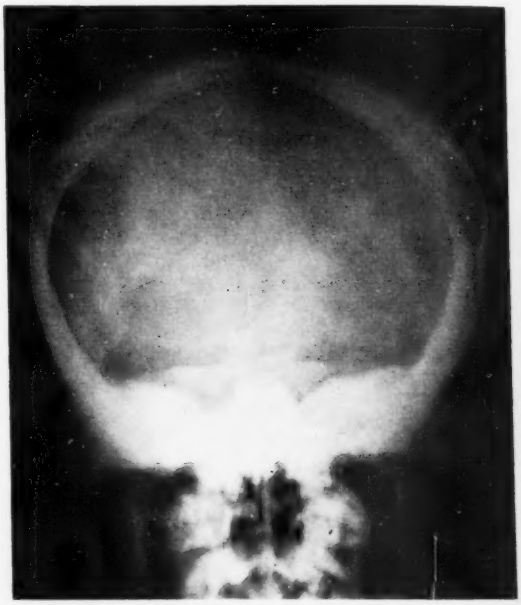


Figure 2 — A.P. skull from case I, age 14. Obliteration of the diploe.

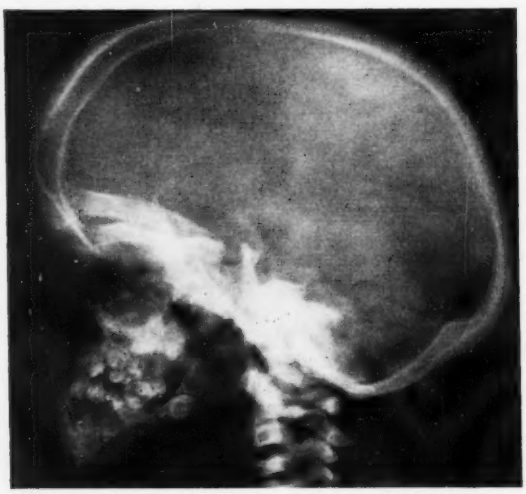


Figure 1 — Lateral skull from case I, age 10. The entire base is sclerotic and thickened. Note involvement of the sella turcica: marked thickening of the clinoid processes and of the floor with encroachment upon the sphenoid sinus. The enlargement of the head is remarkable. The facial bones are hypoplastic.

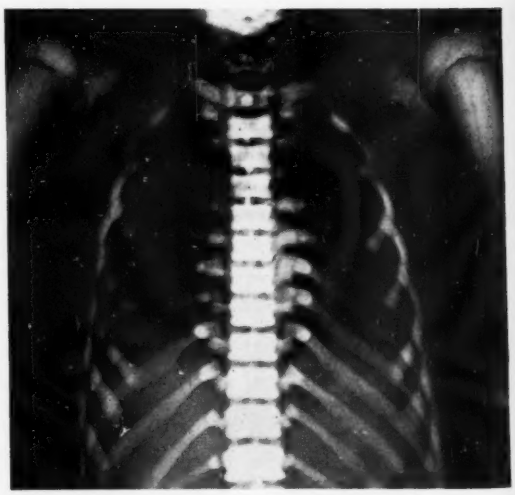


Figure 3 — A.P. Dorsal vertebral spine from case I age 14 (overpenetrated film)

The dense vertebral bodies are well seen. The ribs are symetrically and uniformly dense. Note the clubbing and striations in the upper portions of both humeri.

4) A striped pattern in the body of the iliac bones.
5) Osseous fragility giving predilection to fractures.
6) Transverse and longitudinal striations, particularly in the bone ends.

From the prognostic standpoint we may consider that the first two cases, with familial character, are of the severe type. The optic-atrophy and the deafness result from cranial nerve changes produced by narrowing of the foramina of the base of the skull. The widening and clubbing deformity, the transverse and longitudinal striations in the metaphyses, and the lines of division in some epiphyses seem to be the result of disease occurring very early in the bone development and seriously affecting the bone-forming processes.

The anemia indicates an advanced encroachment upon the marrow spaces, causing a mechanical interference with these hemopoietic centers.

In the malignant type, death often occurs by intercurrent infections and sometimes by aplastic anemia.

Our third patient, who has no clinical symptoms and whose bone changes were found incidentally, represents a benign type of the disease. These patients usually die of some process not related to osteopetrosis.

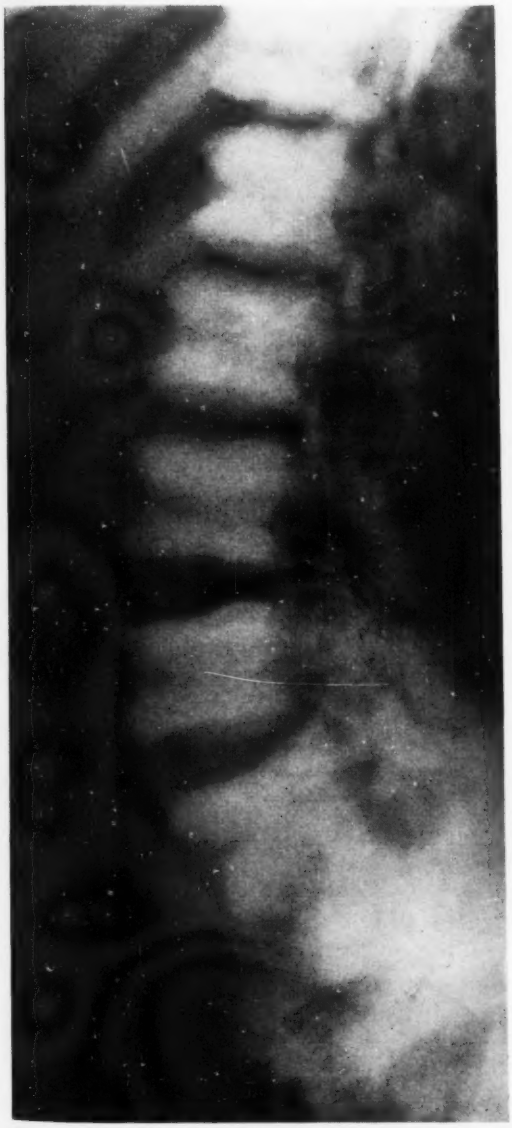


Figure 4 — Lateral lumbar spine from case I age 14. The superior and inferior plates are very dense while the medial portions are less dense.

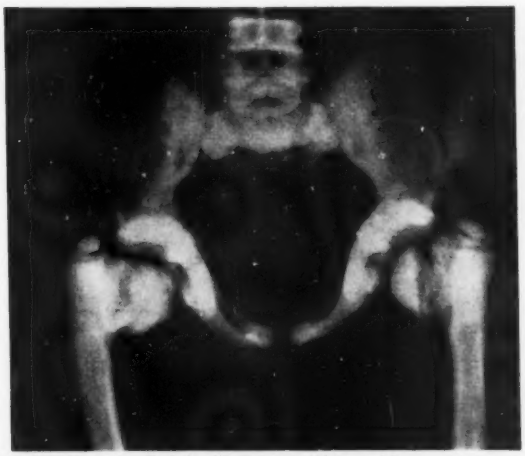


Figure 5 — Pelvis from case I age 10.

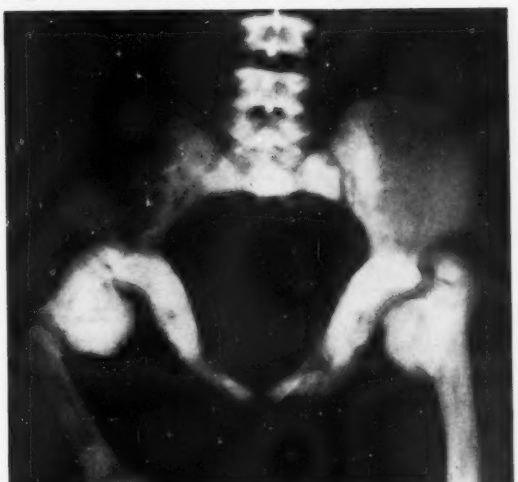


Figure 6 — Pelvis from case I age 14 (over-penetrated film)
The deformities are more pronounced. The ununited fracture of the right femur gives an external angulation. The right femoral head is almost outside the acetabulum.

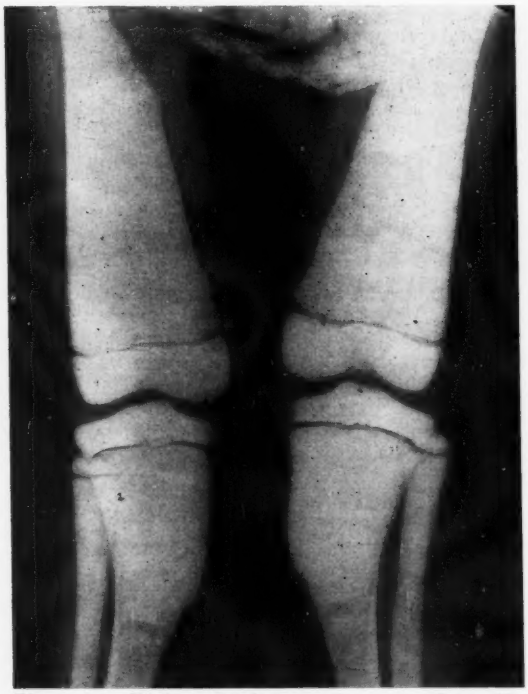


Figure 7 — Right and left knees from case I age 10. There is a tremendous clubbing deformity with thickening of the cortex, and obliteration of the medullary cavity. Vertical striations are visible in the metaphyseal portions of both femora and tibiae.

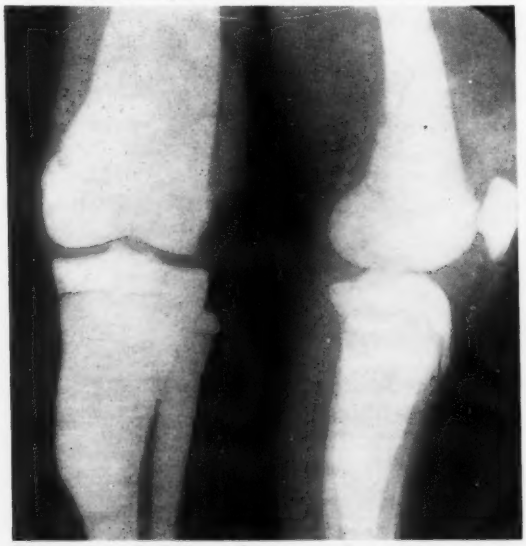


Figure 8 — Left knee from case I age 14. There is more pronounced enlargement than four years ago.

Figure 9 — b) Left leg from case I age 14. ⟹ The fractures seen on the previous films are incompletely consolidated since the fracture lines are still visible. The osteroclerotic involvement is conspicuous at the proximal and distal portions of the tibia while the mid portion is involved to a much lesser degree.

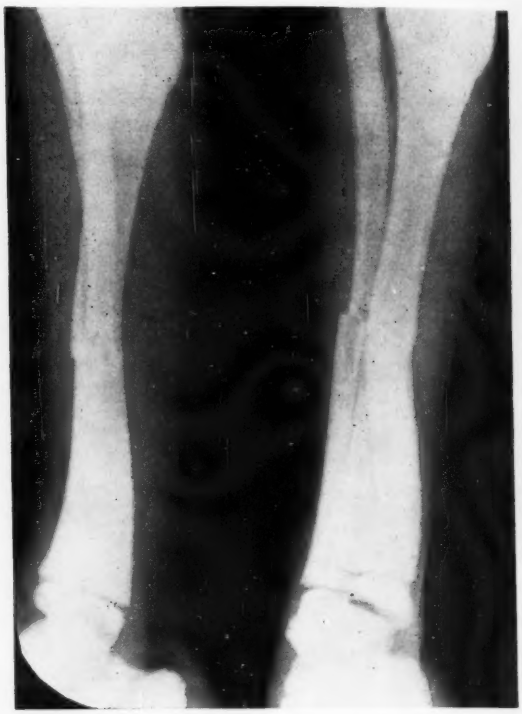
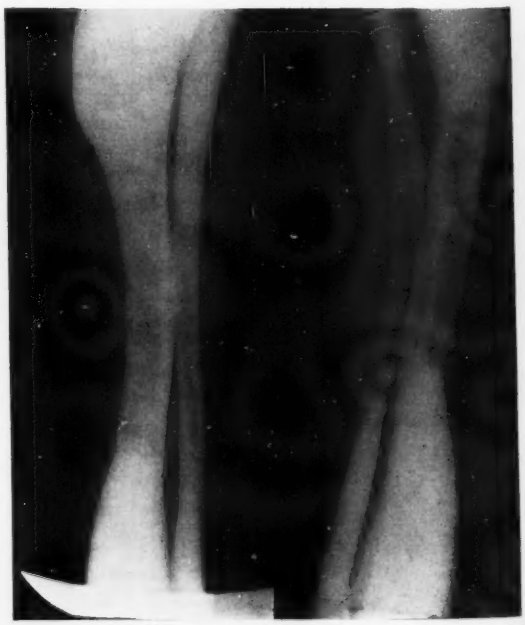


Figure 9 — a) Left leg from case I age 10. There is a pathological transverse fracture in the mid portion of the shaft of the tibia and fibula. These fractures were the cause of the first examination.



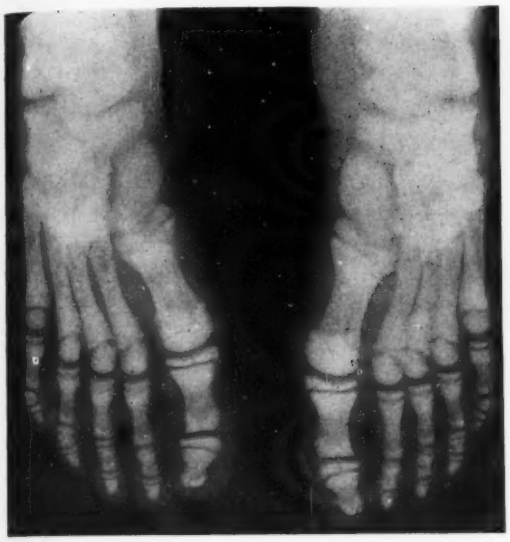


Figure 10 — Feet from case I age 10.
This shows the involvement of the distal portions of the metatarsals and phalanges which are dense and enlarged. A line of section at the epiphysis of the big toes bilaterally is to be noted.

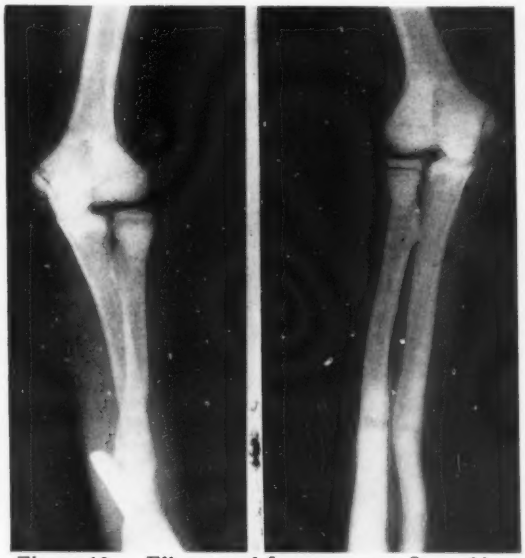


Figure 12 — Elbows and forearms case I age 14.
There is a marked sclerosis of the distal humerus, radial neck, and olecranon bilaterally and symmetrically. The inferior portions of the radius and ulna are very dense and show no medullary cavity. The left radius presents an old ununited fracture.

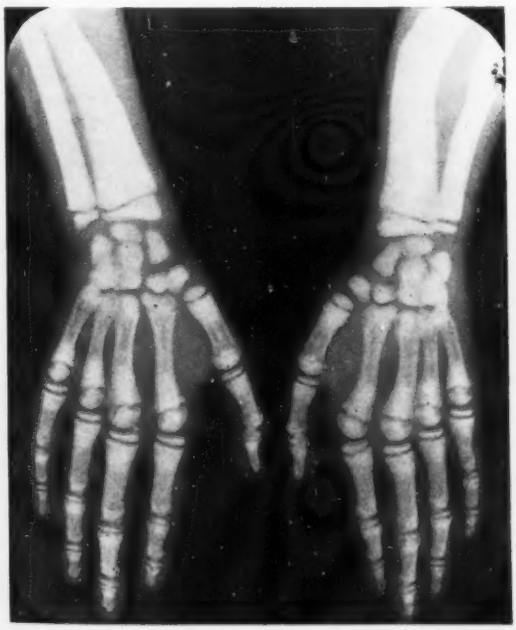


Figure 11 — Right and left hands from case I age 10.
The characteristic signs seen in both hands are approximately similar to those found in the feet. Cracks are also seen in some epiphyses. The carpal bones are very dense.

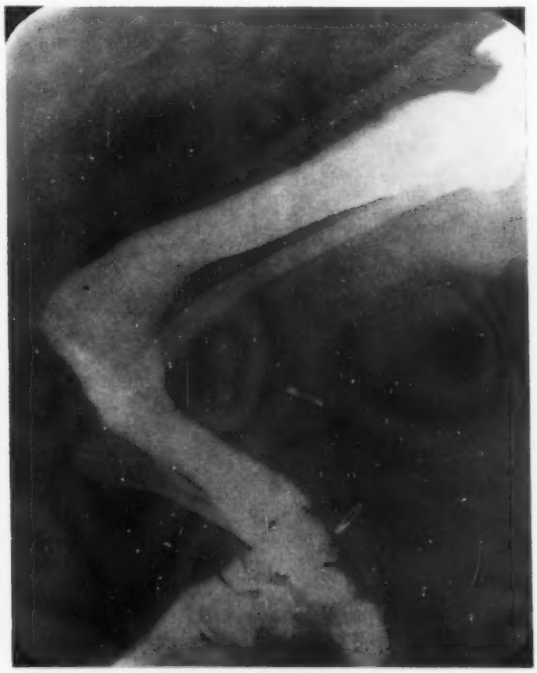


Figure 13 — Right leg from case II.
There is a marked bending deformity of both bones of the leg, owing to a fracture in infancy. The extreme density of the tibia with loss of the medullary cavity is noted.

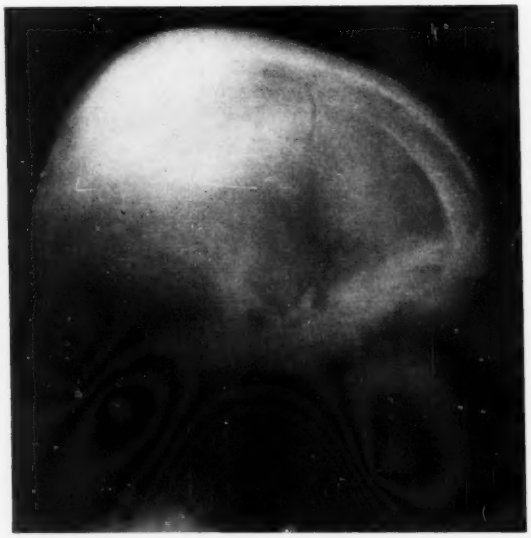


Figure 14 — Lateral skull from case II.
There is homogeneous thickening of the vault and of the base with narrowing of the sella turcica and obliteration of the diploe and of the mastoid cells.

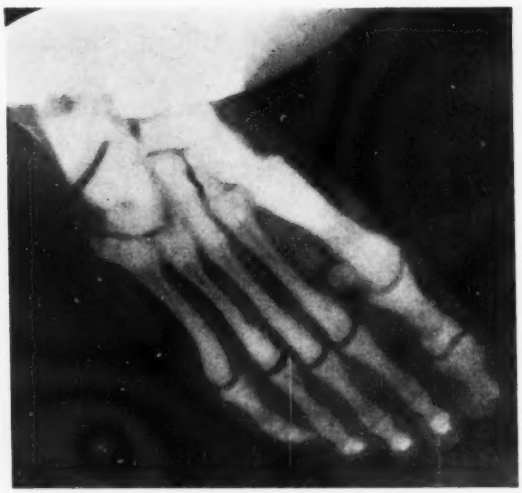


Figure 15 — Left foot from case II.
The osteopetrotic changes are marked in the tarsal bones and in the distal and proximal portions of the metatarsals.

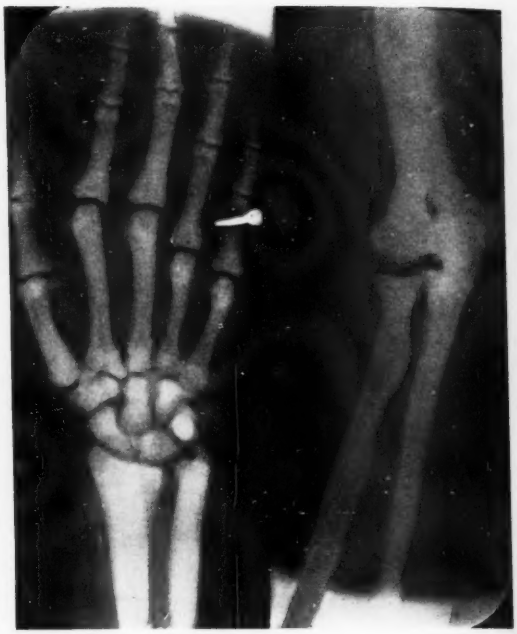


Figure 16 — Left hand and left elbow from case II.
There is a diffuse increased density in the carpals and metacarpals. The fourth metacarpal is underdeveloped. The bones forming the elbow are also involved.

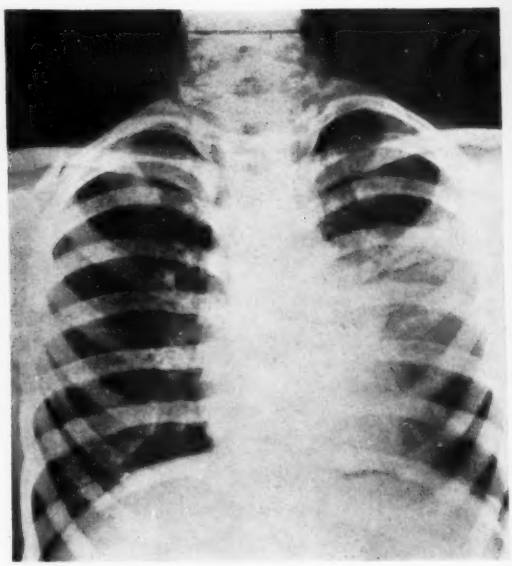


Figure 17 — Chest film from case III age 11.
The film shows a pneumonic consolidation of the left lung. The abnormal density of the ribs was discovered by this examination.

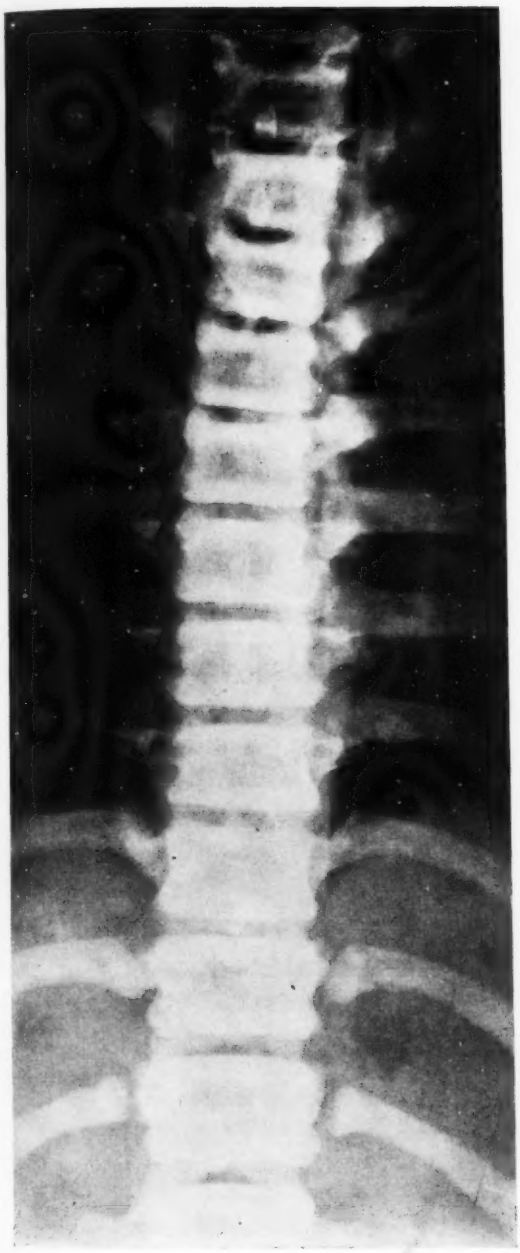


Figure 18 — A.P. dorsal spine from case III.
The superior and inferior plates of the vertebral bodies are very dense whereas the mid portions are of a lesser density.

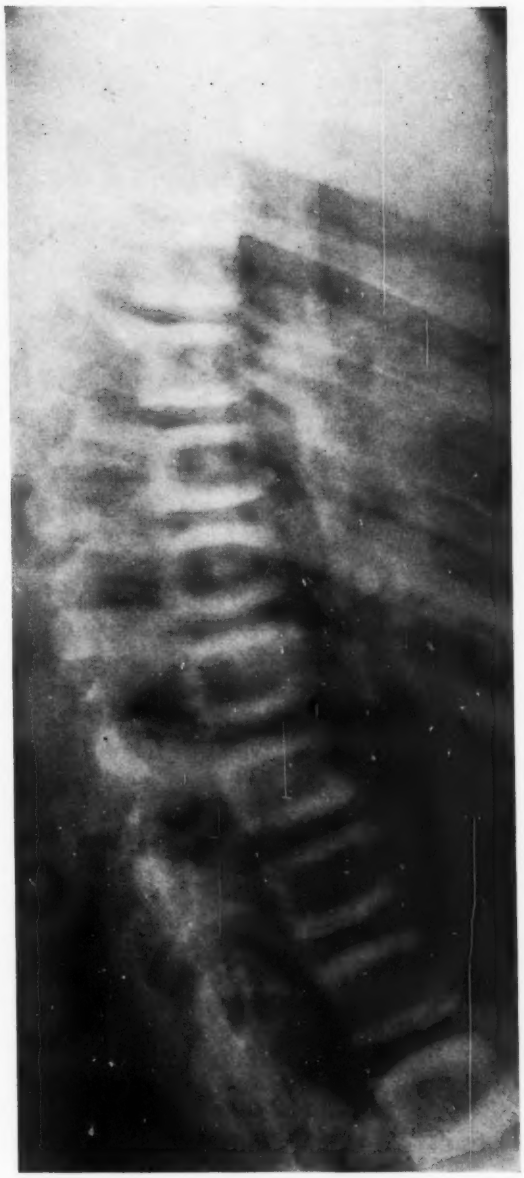


Figure 19 — Lateral dorsal spine from case III.
The increased density of the plates is more clearly seen than in the A.P. view. In the center of the middle part of the body, in the more transparent zone, there is an opaque peashaped nodule.

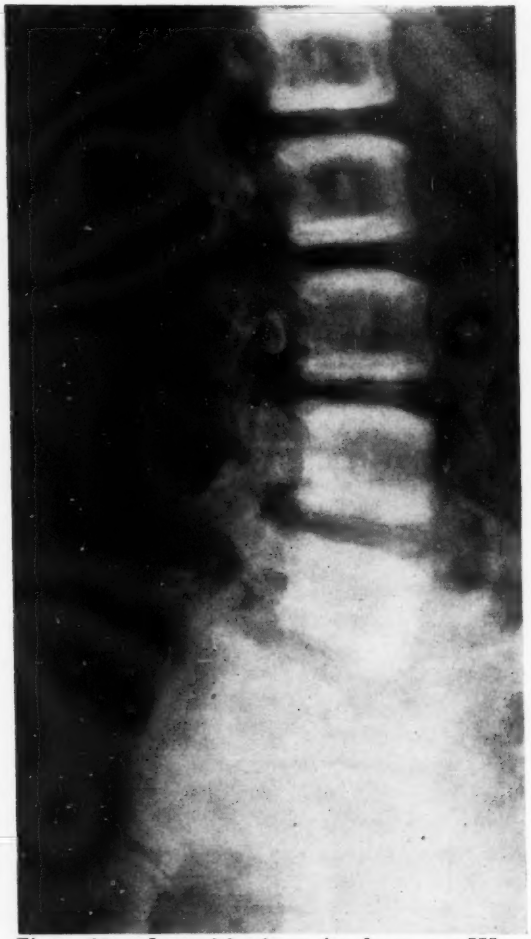


Figure 20 — Lateral lumbar spine from case III.
The abnormalities seen in this region are similar to those seen in the dorsal spine.

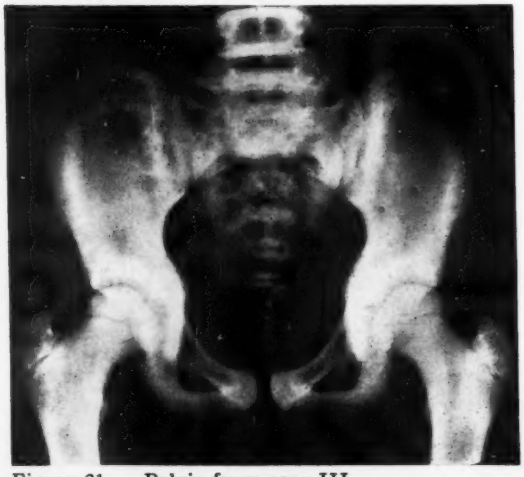


Figure 21 — Pelvis from case III.
The pelvis shows minimal involvement. The film shows alternating and concentric bands of increased and diminished density in both ilia. The acetabula and the upper femora are also affected.

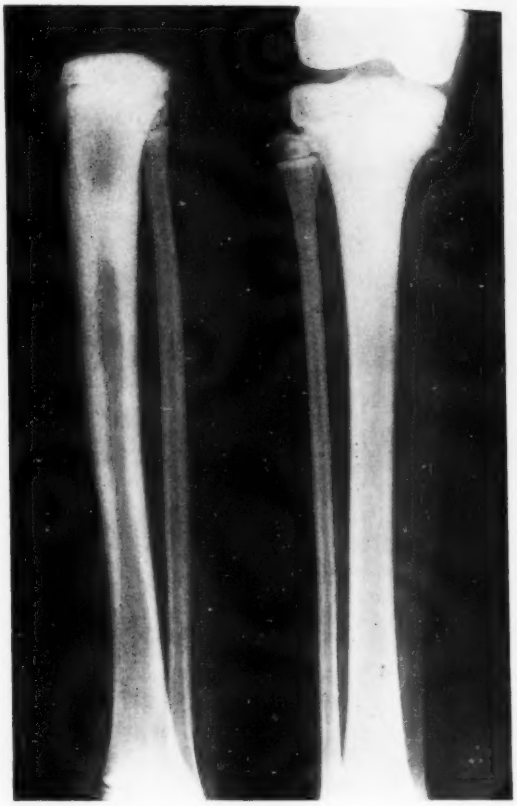


Figure 22 — Left leg from case III.
The upper portion of the tibia is slightly involved.

Differential Diagnosis:

The diseases which may be confused with osteopetrosis are: Fluorine poisoning, hypervitaminosis A and D, Camurati — Engelmann disease, congenital syphilis, hereditary osteosclerosis and myelosclerosis.

Etiology is unknown and no adequate therapy has yet been found.

Summary:

Three cases of osteopetrosis are presented, two of the severe type and one of the benign type. Osseous fragility was present in each case. Radiological characteristics are described.

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LYMPHOSARCOMA OF THE STOMACH

A. J. RICHARDS, M.D.
Regina, Saskatchewan

Lymphosarcoma of the stomach has been reported with increasing frequency in recent years. In April 1952, Snoddy[3] collected 474 cases from the literature including his own and I have been able to find a further 31 cases in the literature since that date. These, along with our own 13 cases brings the total to at least 518 at the present time. This indicates that the disease is much more common than was previously thought. Also, recent studies have shown that a more favourable prognosis may be given than in carcinoma of the stomach if adequate therapy is instituted. Thus, it is important for us to be familiar with the features of this disease, and in particular, with the evidence that will help us to make the diagnosis preoperatively.

Material:

This paper reports a study of all cases of lymphosarcoma involving the stomach which were investigated in the clinics of the Saskatchewan Cancer Commission between the years 1932 to 1954 inclusive. This group of cases includes those in which the stomach involvement was primary and those in which it was part of a more generalized process but excludes those which had extended directly from neighboring organs or glands. No differentiation has been made between those cases with leukemia and those without leukemia.

A total of 576 cases of lymphosarcoma has been reviewed and of these, 42 had intrinsic involvement of the stomach. In 13 of these, the process was primary in the stomach, while in the remainder, it was part of a generalized involvement of the lymphatic system. In all cases the diagnosis has been confirmed pathologically and in most cases, the stomach involvement has also been confirmed. Of these 42 cases, involvement of the stomach was suspected clinically in only 22. In 18 of the 22 cases, the radiological findings were abnormal. The 13 cases in which the process was primarily in the stomach, have been studied separately with regard to treatment and survival. They have also been studied with regard to radiological findings along with those cases in which the gastric involvement was part of a more generalized disease.

Incidence:

This survey provides an unusually good opportunity to study the incidence of malignant disease since the frequency of its occurrence can be accurately related to the total population in a definite geographical area. Watson[10], in a survey of cancer occurring in Saskatchewan in 1948, has reported that 86% of all malignancies were seen by one of the two clinics. It is probable that most of the cases not seen in the clinics are either small skin malignancies or very advanced and hopeless ones and consequently it may be safe to assume that the referal rate of treatable cases since 1948 is much higher than 86%.

During the period of this study, the incidence of lymphosarcoma in any one year varied from 0.3 cases/100,000 of population to 9.8 cases/100,000. The average was 3.2. However, in the early years of the clinics, the referal rate was low. If only the years since Watson's survey are considered, namely 1948 to 1954, the incidence rate is found to vary from 5.3 — 9.8 — and the average is 6.81/100,000. Similarly considered, the incidence of lymphosarcoma of the stomach is 0.63 and of primary lymphosarcoma of the stomach is 0.20. In the same period, 1750 cases of carcinoma of the stomach have been seen, a ratio of 1 case of lymphosarcoma with stomach involvement to 41.6 cases of carcinoma. These cases of lymphosarcoma represent 2.3% of all malignancies of the stomach seen in this period. The cases of primary lymphosarcoma of the stomach are in the ratio of 1 to 135 cases of carcinoma and they represent 0.75% of all malignancies of the stomach. This incidence of 2.3% compares closely with various reports in the literature which give the incidence of lymphosarcoma of the stomach as being 1.5% to 3.2% of all malignancies of the stomach.

The racial incidence was of interest in that 62.5% of the cases were people of Anglo-Saxon or German origin. This is in agreement with the general population of this area in which these groups make up 58.5% of the population. It is concluded that there is no racial predilection for this disease.

The age incidence was of interest (Table I) as most authors have stressed the higher incidence of lymphosarcoma of the stomach in young adults as compared with carcinoma and have recommended this as a diagnostic point. In our series, 59.5% of the cases were in the age range 50 to 80. It is true that in the group of patients whose ages range from 10 to 50 years, there appears to be a comparatively greater incidence of the disease in the third decade.

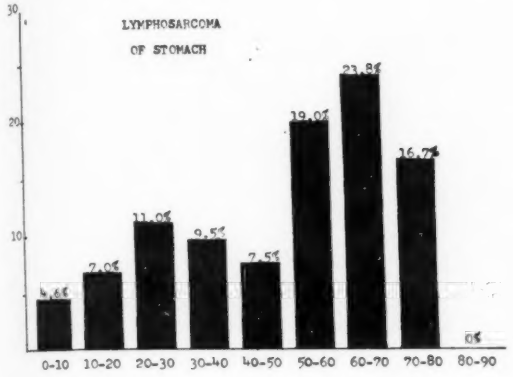


TABLE I

Age incidence of our cases of Lymphosarcoma showing a small increased incidence in the age range 0-40.

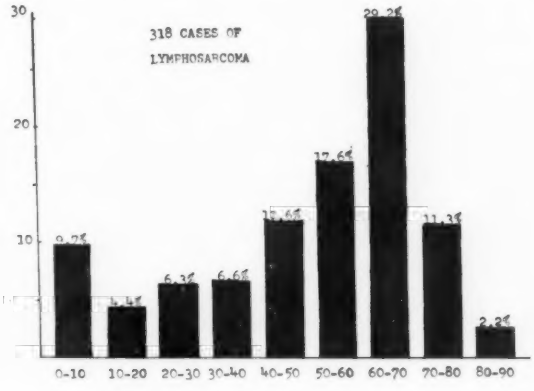


TABLE III

Age incidence of all cases of Lymphosarcoma seen in this period showing a less marked increase in the third decade reducing the value of the findings of table 1.

This does not occur in a study of the age incidence of carcinoma of the stomach, (Table II) and the difference may be of some diagnostic value in patients of this age group.

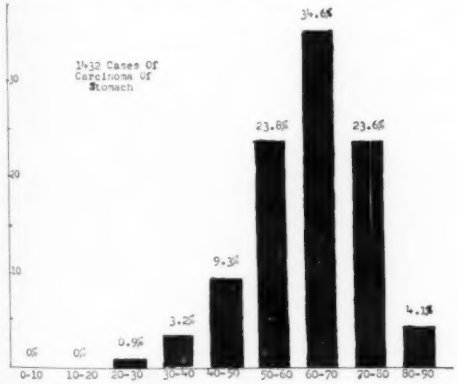


TABLE II

Age incidence of a group of 1432 cases of Carcinoma of the Stomach seen in the same period showing relative rarity of disease in age range 0-40.

It should be noted however that the greater incidence of lymphosarcoma of the stomach in the third decade did not occur in the large group of all lymphosarcomas (Table III). This may tend to reduce the diagnostic value of the age incidence difference between lymphosarcoma and carcinoma of the stomach. A study with larger number of cases would be necessary to determine the significance of the difference in the age incidence between lymphosarcoma of the stomach and lymphosarcoma generally.

The sex incidence is variously reported with a male predominance ranging from 7 to 1 to 1.6 to 1. In our series, there is a male predominance of 3.4 to 1.

Literature:

Most recent reviewers of lymphosarcoma of the stomach conclude that there is no radiological picture pathognomonic or even sufficiently definite to make a diagnosis. However, Yarnis and Colp are quoted by Deeb and Stilson[1], as grouping the findings into two main classes.

In one class the stomach is diffusely infiltrated causing hypertrophy of the rugae, while in the other, there is definite tumour formation often with ulceration. The first group is indistinguishable from so called "giant hypertrophic gastritis", while the second group is usually considered a large carcinoma until pathologically proven otherwise. Archer and Cooper[2] conclude that there is nothing characteristic about either the tumour or the ulcer in the second group, while others feel that the large size of the filling defect in a patient who has a relatively short history and who looks well is a definite help.

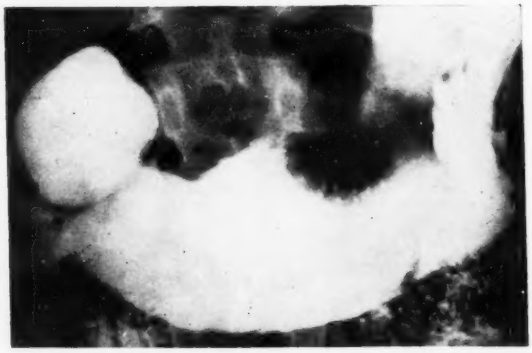
Weber, Kirklin and Pugh[4] of the Mayo Clinic have stated that peristalsis is preserved in a number of these cases, and they consider that this is a differential point.

Radiological Findings:

I have attempted to analyze the radiological findings in the 22 cases in which films are available under the headings "Deformity," "Ulceration," "Mucosal Pattern," "Rigidity," "Peristalsis," "Duodenal Changes."

All cases in which a deformity of the stomach was present fell into two groups. Those primarily infiltrating and those primarily polypoid, but many cases combined the features of both and it was not considered of significance to try and differentiate them. There was 16 in this group, 5 primarily polypoid and 11 primarily infiltrating.

An example of this type of case is Mr. G. O. (Case I) aged 24, who was in excellent health until the summer of 1947 when he experienced occasional episodes of nausea, each time with eructation of small amounts of sour watery material. No blood and no vomiting of food occurred. Over the next few months the attacks increased in frequency.



Case I — Mr. G. O. aged 24 who had primary lymphosarcoma of stomach with a large polypoid type of filling defect. At autopsy there was a large mass filling the upper half of the abdomen arising from the greater curvature of stomach.

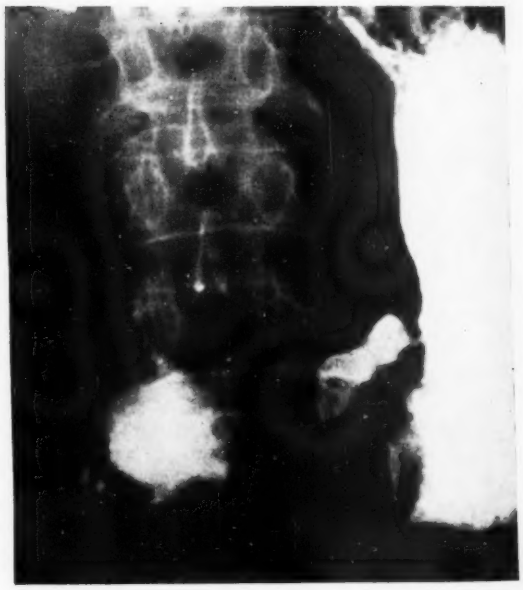
In January 1948, the nausea became constant and there was deterioration in appetite. Amphojel was prescribed and was of some help. By the end of January he was having pain in the left upper quadrant which radiated through to his back. This had increased in severity and frequency.

One night in February 1948, he felt a lump in his left upper abdomen. Returning to his doctor he was admitted to hospital and was found to have a large mass in the left upper quadrant. X-ray studies revealed a large filling defect of the stomach accurately related to the mass in the abdomen.

A laparotomy was carried out and the mass was found and considered non-resectable. A biopsy was taken and post-operative radiotherapy was given, however the patient went rapidly downhill and died. Autopsy confirmed the biopsy diagnosis of lymphosarcoma and showed a large mass occupying the upper half of the abdomen. The stomach was dilated and the mucosa was replaced by a fungating mass occupying the entire greater curvature completely encircling the stomach.

Only 8 cases were ulcerated and of these 5 were huge ulcers and 1 was of medium size. These were deep as well as broad. This would tend to bear out the impression quoted from the literature that the large size of the ulcer as well as of the filling defect is of diagnostic value.

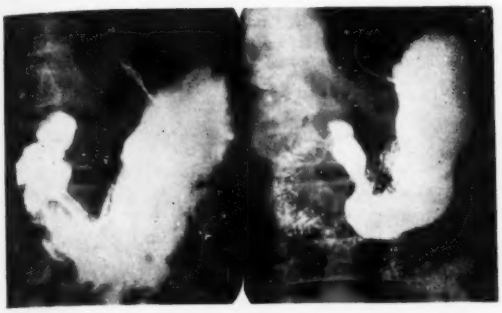
An example of this type of case is Mr. W. R. (Case II) aged 67. This man was well until the summer of 1949 when he became weak and tired. These symptoms were accompanied by loss of appetite. In December 1949, he developed a slight burning pain which was often relieved by vomiting. He was admitted to hospital where examination revealed nothing of significance. X-ray studies however showed a large filling defect with broad and deep ulcer. Haematological studies and other laboratory investigations were within normal limits, except that occult blood was present in both gastric contents and in stool. A laparotomy confirmed the radiological impression and subtotal gastrectomy was carried out. The large ulcer was found in the centre of a large area of infiltration. However the patient died and autopsy revealed no further evidence of disease.



Case II — Mr. W. R. aged 67. One example of a number of cases with large broad deep ulcer. Autopsy revealed no further evidence of disease.

The mucosal pattern was grossly abnormal in 9 cases with thickening of the folds in all. Irregularity was not a marked feature. The thickening was more outstanding in most cases.

An example of this type of case is Mr. G. C. (Case III) aged 67. This patient was quite well until May 1951 when he began to be troubled by hunger pain. This pain came on three hours after eating and was relieved by taking food.



Case III — Mr. G. C. aged 67. An example of lymphosarcoma with enlarged rugal folds. Diagnosis by gland biopsy with complete recovery for two years after radiation therapy.

On examination, the only finding of interest was an enlarged spleen and some enlarged nodes in the supraclavicular, axillary and inguinal areas. Retroperitoneal nodes were also involved.

X-ray studies at that time revealed a very coarse rugal pattern but no definite malignancy was thought to be present.

X-ray therapy to the entire abdomen, neck, axilla and mediastinum was given, and since that time the patient has been well without evidence of disease for 2½ years until his most recent review, at which time he has developed evidence of lymphosarcoma involvement in the lachrymal glands. In this case, the diagnosis was proven by a gland biopsy and the stomach involvement was inferred from clinical and radiological improvement, shown in the illustration.

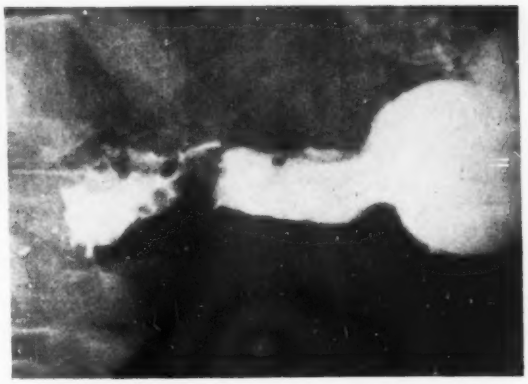
The question of rigidity and peristalsis was of special interest in view of the report of Weber, Kirklin and Pugh, that peristalsis was retained or partially retained in some of these cases.

In 6 of our cases the stomach was considered rigid while in 7 the stomach was only semi-rigid and in a further 7, there was no rigidity. In 2 cases a decision could not be reached.

In 10 cases, peristalsis was absent. In 11, it was either normal or sluggish.

In no case did duodenal changes point directly to stomach involvement. In 9 cases however, deformities were present which could have been caused by involvement of neighbouring glands or pancreas. This type of information may be of help in some cases.

An example of this type of change is Mr. H. O. (Case IV) aged 70. This man was well until March 1949 when he developed symptoms of anorexia and early satiety. He became constipated and lost 30 lbs. of weight in 2 months. He did not have melena. His strength gradually diminished.



Case IV — Mr. H. O. aged 70 presented clinical picture of enlargement of spleen. At autopsy many mesenteric glands were involved with hyphosarcoma around the head of pancreas as well as involvement of pancreas itself.

On examination, a large hard notched spleen filled the whole left subcostal area. In addition, there was a rounded mobile tumour 5 cms. in diameter in the lower abdomen. Enlarged glands were present in both anterior and posterior cervical areas. Other glands were present in the supraclavicular, axillary and inguinal areas.

X-ray investigation showed the stomach to be normal but suggested enlargement of the pancreas and invasion of the duodenum.

Deep X-ray therapy was given to the trunk but in spite of this, the patient died on December 5 with massive lymphosarcoma and a leukemic phase that developed 2 months prior to death.

At autopsy, numerous enlarged glands were present in the mesentery measuring up to 4 to 5 cms. in diameter. Most were discrete but many matted. The stomach was normal grossly but on microscopic examination had dense masses of lymphocytes in the mucosa and submucosal layers.

Symptoms

An analysis of the symptom pattern in 42 cases in this study revealed that in 10 cases the general disease preceded the local disease while the reverse was true in 6 cases. In 18 there were no gastric symptoms while in 7 cases there were no general symptoms. Those cases in which were no general symptoms and those in which the local symptoms preceded the general symptoms made up the group considered to be primary Lymphosarcoma of the stomach.

The first symptom was pain, anorexia, loss of weight or weakness in 20 cases. Later in the course of the illness, either the triad fullness, nausea, vomiting or the triad anorexia, loss of weight, weakness developed in well over ¾ of the cases.

Blood and other laboratory investigations were not of value in these cases except to establish the general diagnosis in cases where leukemia was present.

Treatment and Results:

While our series of 13 cases of primary lymphosarcoma of the stomach is small and the follow-up period short, 4 are alive and well 1 to 5 years post-operatively which tends to bear out the opinion quoted that the prognosis is better than in carcinoma of the stomach.

Conclusions:

In this study we have been able to establish the incidence in the total population of Saskatchewan of lymphosarcoma generally and of lymphosarcoma of the stomach in particular. Over the period between 1932 to 1954 inclusive, 6.81 cases of lymphosarcoma / 100,000 have been found and 0.63 cases / 100,000 have been found with stomach involvement. The incidence of lymphosarcoma of the stomach as compared with all malignancies of the stomach shows it to represent 2.3% of the total malignancies of the stomach.

Many of the features of lymphosarcoma of the stomach simulate carcinoma so closely that differentiation is difficult. In view of the prognosis of this disease, pre-operative diagnosis is of great importance.

The usual radiological findings are:

(1) Large polypoid or infiltrating defect out of proportion to the severity of the clinic picture.

(2) Enlarged rugal folds.

(3) Peristalsis and pliability not completely eliminated.

(4) Ulcer usually deep and large when present.

If we consider the possibility of lymphosarcoma of the stomach when any of these findings are present, further investigation will establish the diagnosis more frequently in the pre-operative period.

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In Memoriam

It is with deep regret that the Canadian Association of Radiologists records the deaths of four radiologists during 1955.

GOSSELIN, Jules
June 19th, 1901, Quebec City, Quebec
M.D. — Université Laval, 1925

MICHON, Jean
January 13th, 1915, Montreal, Quebec
M.D. — Université de Montréal, 1941

PERRAS, Ephrem
January 11th, 1897, Thurso, Quebec
M.D. — Université de Montréal, 1924

WHEELER, Digby
August 27th, 1892, Brantford, Ontario
M.D., C.M. — University of Manitoba, 1916.

MALIGNANT PULMONARY LESION WITH CALCIFICATION*

I. SEDLEZKY, M.D.
Montreal, Que.

In the investigation of solitary pulmonary masses, it has generally been accepted that demonstration of calcium as an integral part of the mass ruled out the likelihood of a malignant neoplasm. For example, in a recent paper, Jewett[3] states that the only solitary lesion which may be watched without danger is one containing calcium. Such a lesion is either a tuberculoma or a benign tumor. Good et al[1] of the Mayo Clinic emphasize this point in a discussion of the significance of a solitary mass in the lung. They state that "frank roentgenologic evidence of calcification in a solitary mass in the lung is almost certain proof of its benign nature." They further suggest that "it is conceivable that a bronchogenic carcinoma could develop in a position of the lung where calcium had been deposited as a result of some inflammatory process and could engulf this remnant of former disease in such a manner that the mass formed by the cancer would appear to be calcified." These authors themselves have never seen such a case and believe that it must be very rare.

Sporadic reports to the contrary have been appearing in the literature. The purpose of this presentation is to re-emphasize the fact that calcification in a solitary pulmonary mass does not permit one to invariably exclude the possibility of malignancy.

Case Report

N.A., a white male, aged 48 years, was free of complaints referable to his chest, when he had his first chest radiograph taken during February 1951. On this occasion (Fig. 1), and on Nov. 13th, 1951, a left hilar mass which had not varied in size was noted. Fifteen months later, during February 1953, he returned complaining of cough and mucoid expectoration, both of two months duration. The previously noted mass was now slightly larger. It occupied a posterior position and exhibited central calcification (Fig. 2). The diagnoses entertained at this time were tuberculoma or chondroma (hamartoma). The cough and expectoration persisted and during the two-month period prior to July 16, 1953, additional complaints were nausea and sweating. Within a period of six weeks he had lost 15 pounds in weight, and had been febrile for the five days prior to admission.

Figure I. — A rounded mass can be seen superimposed on the left hilum.

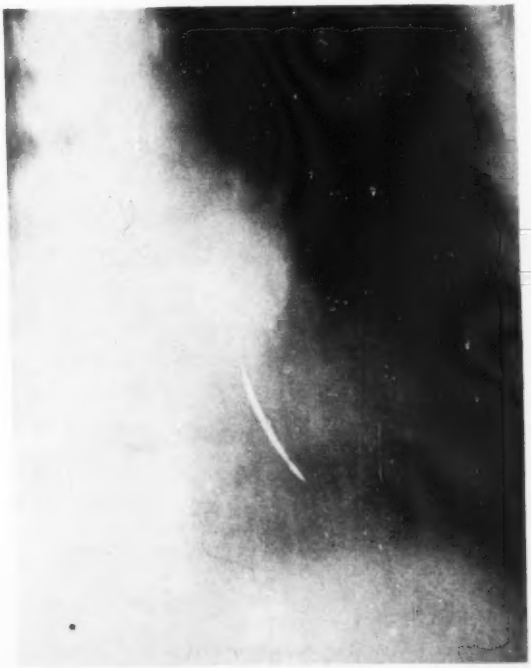

Figure II. — Tomogram shows the well defined mass containing some central calcification.

Presented at Annual Meeting, The Canadian Association of Radiologists, January 11, 1955, Ottawa.

On July 16, 1953, radiographic examinations revealed a complete, left-sided opacity. The mediastinal contents were drawn over to the same side. The findings all pointed to major bronchial obstruction (Figs. 3 and 4).

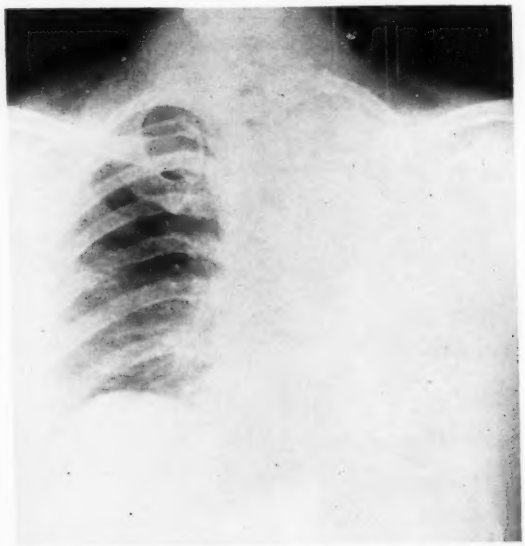

Figure III. — Uniform obscurity of the left hemithorax with shift of the mediastinal contents to the left, apparently representing collapse of the left lung.

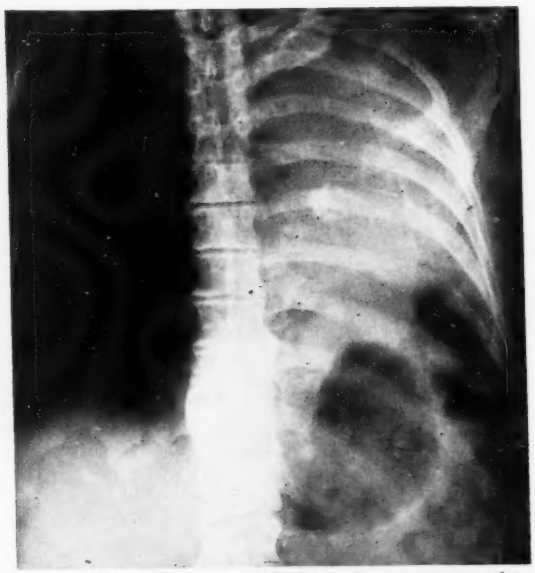

Figure IV. — Overexposed film demonstrates the calcification and shows the sharp cut-off of the left main bronchus.

Two bronchoscopic examinations revealed an elevated but intact mucosa in the left major bronchus. The tissue removed for histological examination failed to reveal the presence of tumor cells.

An exploratory thoracotomy was undertaken on September 8th, 1953. A large, hard mass was found occupying almost the entire left lower lobe. Grossly the lesion suggested a bronchogenic carcinoma. A successful total pneumonectomy was performed.

Pathology: The intrapulmonary encapsulated mass measured 10 x 6 x 5 cms., occupied the greater part of the atelectatic left lower lobe and extended posteriorly to the visceral pleura. The posteriorly calcified mass impinged on the posterior aspect of the left main bronchus but did not invade it. Histologically the cartilagenous-like mass showed osteoid changes, marked cellular proliferation and vascular invasion. The anatomical diagnosis was *osteochondrosarcoma*, probably arising in a hamartoma.

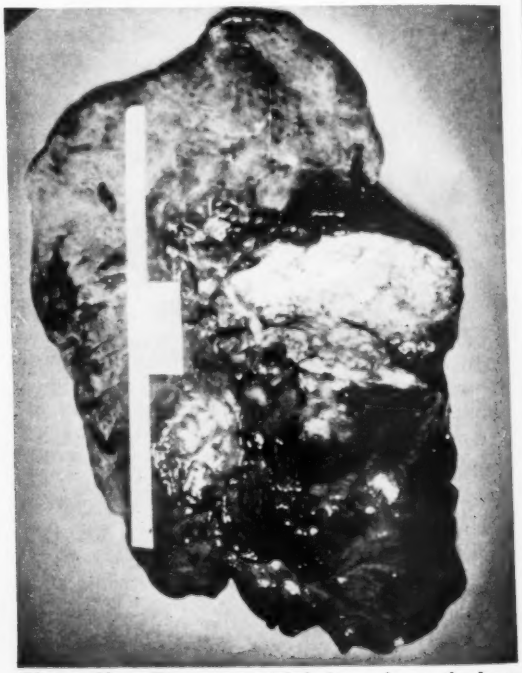

Figure V. — The removed left lung shows the large tumor mass in the right central position (reproduction from colored slide).

Discussion

In a recent comprehensive paper on pulmonary hamartoma by Stein et al[8], the possibility of malignant degeneration of these lesions is mentioned but is not considered important. They believe that wider removal such as lobectomy or pneumonectomy is unnecessary. The authors are apparently not impressed by the experience of Verga[9] to whose paper they refer. Verga reported a tendency to invasion in one of his cases and listed several examples where metastases had apparently occurred.

Simon and Ballon[7] reported a case showing probable malignant degeneration in a pulmonary hamartoma as demonstrated by marked cellular proliferation and capsule invasion.

Greenspon[2] and Lowell and Tuhy[6] both have reported primary chondrosarcoma of the lung which they feel did not arise in a pre-existing pulmonary chondroma.

In the discussion which followed the paper by Good et al referred to above, Hodes said that they had seen four patients with calcified primary nodules, which when closely followed, ultimately revealed bronchogenic carcinoma. Friedman and several others in the audience reported that they had seen calcification in pulmonary adenomas.

London and Winter[5] have recently reported a case of an isolated pulmonary nodule containing calcium which was found to be a slow-growing, well differentiated adenocarcinoma. The calcification was found on histologic study to occupy alveolar spaces lined by malignant cells.

Liebow[4] has described a similar case of calcification in an adenocarcinoma.

London and Winter feel that the discovery of an isolated pulmonary nodule is an indication for exploratory thoracotomy in the cancer age group despite calcification.

In spite of all that has been said above, a calcified primary malignant neoplasm in the lung is still exceedingly rare. If, however, the lesion does show some evidence of growth, thoracotomy is indicated.

Summary

A case has been described in detail in which a solitary round partially calcified pulmonary mass, considered to be benign, began growing rapidly and showed histological characteristics of a malignant tumor, namely an osteochondrosarcoma which had developed in a pulmonary hamartoma.

The opinions of Simon and Ballon as well as Varga, who have suggested that pulmonary hamartoma may show malignant alteration, are thus supported.

Attention is drawn to reported cases of bronchogenic carcinoma and pulmonary adenomas containing calcium.

Conclusion

The presence of calcification in a solitary pulmonary mass, contrary to generally accepted opinion, cannot be relied upon as an indication of the benign nature of the mass.

Acknowledgement:

The author is grateful to Dr. H. C. Ballon and Dr. M. A. Simon for their valuable help with this paper.

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MEETING

19th Annual Meeting — The Canadian Association of Radiologists

The 19th Annual Meeting will be held in Vancouver at the Hotel Vancouver, January 16th, 17th, 18th, 1956. If you have not done so already, you are urged to make your hotel reservation immediately by sending in the form included in Bulletin 58 of November 22nd, 1955.

CALCIFICATION OF THE BASAL GANGLIA OF THE BRAIN

VICTOR SZYRYNSKI, M.D., Ph. D.*
Ottawa

The purpose of this paper is to present an interesting case of calcification of the basal ganglia of the brain, visible on the X-ray films, to summarize the present day knowledge of this syndrome, and to demonstrate the difference between calcified basal ganglia and calcified choroid plexuses.

N.Y., a white male veteran, 50 years old, was involved in a car accident in July 1952. The X-ray of his lumbar spine and pelvis revealed fractures of the transverse processes of the 1st and 3rd lumbar segments on the right side. The texture and configuration of the vertebral bodies (and the pelvis) were not remarkable.

Radiographs of the skull were made and did not reveal any effect of the injury. Symmetrical opacities were found inside the brain, corresponding in their position to the caudate and lenticular nuclei and to the dentate nuclei in the cerebellum. This was diagnosed as calcification of the basal ganglia of the brain. The pineal body was also calcified, but not displaced.

After this neuroradiological diagnosis, neuropsychiatric investigations were carried out. The patient was found to have come from farming stock. His father died of diabetes and "cancer in the mouth" His mother died of cancer of the stomach. Of two brothers, both are dead: one of diabetes at the age of 54, the other was drowned at the age of 26. The whole family came to this country from Ireland three generations ago. There was no history of epilepsy or any clear-cut case of mental deficiency.

The patient believes he was healthy most of his life. He reached form 2 at High School. He was a poor student and repeated grade 4 (public) and grade 1 (high). He quit school because he "could not see well." One year after leaving school his eyesight improved again. He was working on the farm and became a "landscape gardener." In 1941 he joined the Army and was a cook for 4 years, serving overseas. He left the Army in 1945 as his eyes were bothering him again. He had to "blink" all the time and he believed it was due to his "nerves." When he gets excited his eyes "get tight and he has to shut them." They do not bother him when he is alone.

In 1950 he noticed slight tremor of the right hand, and soon after of the left hand. He believed his speech was always slow, and lately he developed some stuttering. He never had any serious headache. He has always been of a quiet disposition.

In 1951 a small cancerous growth was removed from his rectal mucosa. There was no after effect.

Neurological examination

The patient was co-operative and rather cheerful. Speech was slightly thick with occasional slight stuttering which the patient considered to have begun about half a year ago. The mobility of the face was rather diminished, although not amounting to pure mask-like Parkinsonian facies.

Gait was slow and slightly unbalanced. The patient walked in a straight line with closed eyes. There was no Romberg sign.

There was a tic-like movement of his eyelids, bilaterally synchronous. He closed and tightened them every few seconds. There was definite tremor in the fingers of both hands, more marked on the right side, which disappeared on any attempt to perform skilled movements. He was able to carry a cup of coffee quite easily.

Cogwheel rigidity was quite noticeable on both sides in the wrist and elbow joints. On finger-to-nose test slight tremor was found at the very end of the movement bilaterally. Diadokokinesis was rather good. Barany's finger test was good bilaterally.

There were free movements in both hip and knee joints. On passive movements of both ankle joints there was slight impairment of relaxation after passive dorsiflexion of both feet with the tendons of the tibialis anticus remaining tight for a while after removal of the examiner's hand from the sole (a sign observed by Westphal in extrapyramidal syndrome). Cranial nerves were not remarkable. Eye movements, fundi, visual fields and pupillary reflexes were normal. No facial asymmetry was seen. The tongue protruded in the mid-line. There was good elevation of the soft palate on phonation. Sensation to light touch and pin-prick was well preserved on the face and the whole body. Corneal reflexes were normal. Very slight Chvostek's sign was present bilaterally.

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*Presented before the Canadian Association of Radiologists, Annual Meeting, January 11, 1955, Ottawa.

Muscular power and range of movements were full in all extremities. Reflexes were all equal and of average intensity. No spastic signs were found — Babinski, Oppenheim and Rossolimo were absent.

Position and vibration sense were good in fingers and toes. Written numbers on the patient's palms were well recognized.

Mentally the patient appeared to be cheerful and of average intelligence. It was noticed by a few independent observers that he had a tendency to repeat the content of any question or remark before answering it. It did not interfere with intelligent conversation, but was quite noticeable.

Psychological tests

Wechsler-Bellevue Adult Intelligence Scale: Full I.Q. 89, Verbal I.Q. 95, Performance I.Q. 85. It was felt that performance tests were impaired due to the marked tremor of both hands. A low-average intelligence was concluded with some hysterical tendencies suggested by the Rorschach test.

EEG, September 15, 1952: Record within normal limits, with very insignificant response to hyperentilation.

Urinalysis, September 11, 1952: pH 5; Sp. Gr. 1020, Alb 0, Sugar 0, Acetone 0, some mucous, 0-2 pus cells.

Blood: September 11, 1952: Calcium 9.4 mgm.%, Phosph. 3.7 mgm.%.

September 12, 1952: Calcium 9.6 mgm.%, Phosph. 3.4 mgm.%. W.R. — no reaction.

W.B.C., 5,600; R.B.C., 5,300,000; Hb., 13.4 Gm. or 85%; Sed. rate, 5mm/1hr.

X-ray film of the chest: August 16, 1951. No evident pathology.

Ophthalmological consultation: June 18, 1951. Media and fundi normal, Vision rt. 6/18, lt. 6/120

March 1, 1954. "Hysterical blepharospasm."

The control X-ray film of the skull on December 21, 1954, showed no appreciable change in calcification of the basal ganglia in comparison with the film taken in July, 1952.

Discussion

Forty-three cases of calcification of the basal ganglia have been reported in the literature. Some of them were reported on the strength of pathological investigations, and since the publication of Fritche (1935) and the papers of Camp[2] and his group, the radiologically visible calcifications have been described. In Canada the first and only case, as far as we know, was presented in 1951 at the Annual Meeting of the Canadian Neurological Society by Dr. Alan Douglas of London, Ontario. In the same year Foley[5] published an excellent paper outlining a very clear classification of this condition. Discussing the 39 cases previously described and presenting 3 new cases in one family studied by himself, he suggests subdivision into two groups:

(a) Cases associated with hypoparathyroidism, including pseudohypoparathyroidism of Albright;

(b) Cases not associated with hypoparathyroidism.

In the second group he correlates cases with evidence of familial occurrence and uniform clinical picture with "mental retardation and epilepsy dating from childhood, with further deterioration in early adult life and a mixed pyramidal—extrapyramidal syndrome." The second sub-group has no clear-cut corresponding clinical picture and comprises both familial and sporadic cases.

In cases with hypoparathyroidism, mental deterioration and epilepsy dominate the clinical picture, with some behaviour disorders amounting to psychotic episodes. Signs and symptoms of parathyroid insufficiency are also present. The case presented by Douglas, with behaviour difficulties in childhood, ocular cataracts, mild extrapyramidal disturbances, epileptic seizures and mental deficiency with an I.Q. of 76, who finally, after a few psychotic episodes, was committed to a mental hospital, would belong to the same group. Blood calcium of 6.5 to 7.5 mgm.% and phosphorus of 4.5 - 5.5 mgm.% was found in this case on a few occasions.

No disturbance in the calcium/phosphorus balance has been found in our case. There was no epilepsy and no EEG abnormality. Besides mild Parkinsonian syndrome, low average intelligence and pseudo-neurotic complaints no other clinical abnormality was found in spite of a clear radiological picture. Unfortunately, the family could not be investigated in this case.

From the histopathological point of view calcification of the vessels in the basal ganglia is rather commonly found in people over middle age. It is very infrequent, however, that it is so pronounced as to be radiologically visible. At the present time it has been found mainly, as Foley states, in cases with hypoparathyroidism and in some familial cases, where probably some genetic predisposition of certain vascular areas to these changes were

found. The suspicion was raised, that in those cases some transient hypoparathyroid insufficiency was present at some period of life or that they were subjected to mild effects of Kernicterus. There has never been found, however, any adequate proof in case histories for such assumptions.

Calcifications in this syndrome are usually found in the adventitia and in the media of the arterioles and also in the capillaries. Deposition of calcium is usually preceded by hyaline changes in the above layers.

On reviewing the roentgenological appearance of the reported cases we may distinguish four complexes of calcification, all of them being usually symmetrical, but only some of them appearing in different cases reported.

They are:

1. Calcification of the dentate nuclei;
2. calcification of the lenticular nuclei;
3. calcification of the caudate nuclei, and
4. calcification of the pineal-habenular complex.

The greatest difficulty is usually encountered in differentiating between the caudate and the lenticular nuclei — sometimes it is practically impossible without air studies of the ventricular system. Some assistance may be obtained by comparing the lateral and the fronto-occipital views (half axial), when the caudate calcification appears respectively above the lenticular one or in the forks of the V spaces on each side, formed by the lenticular and dentate shadows. In such a way we believe that in our case only the dentate, pineal and lenticular complexes are represented, (Fig. 1, 2 and 3), while one of Foley's cases features all four calcified complexes. There are also cases, when only one complex, other than the pineal is present.

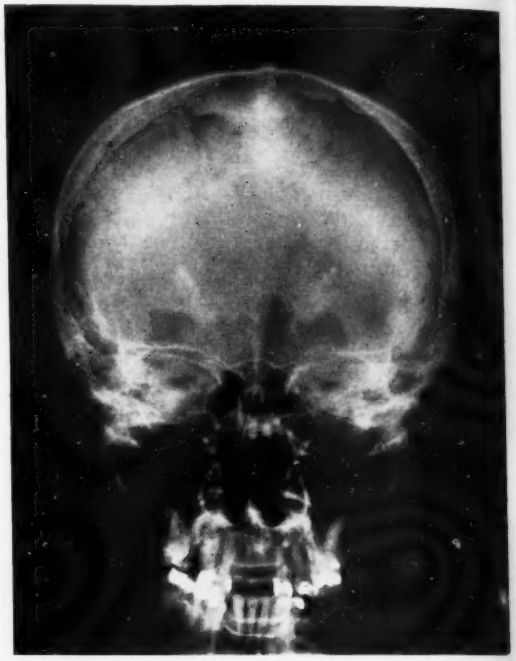

Fig. 2 — Occipito-frontal view of the same skull.

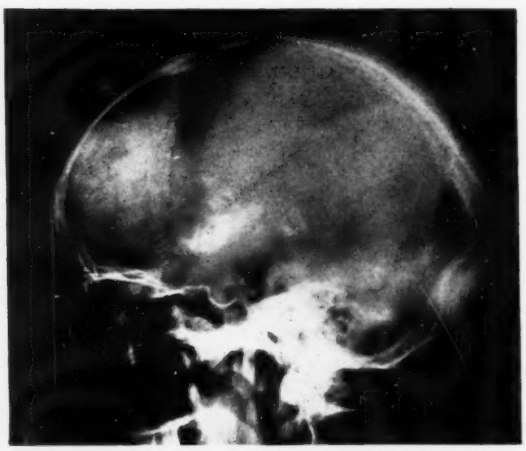

Fig. 1 — Calcification of the lenticular nuclei and of the pineal-habenular complex — lateral view. Calcified dentate nuclei seen in the posterior fossa.

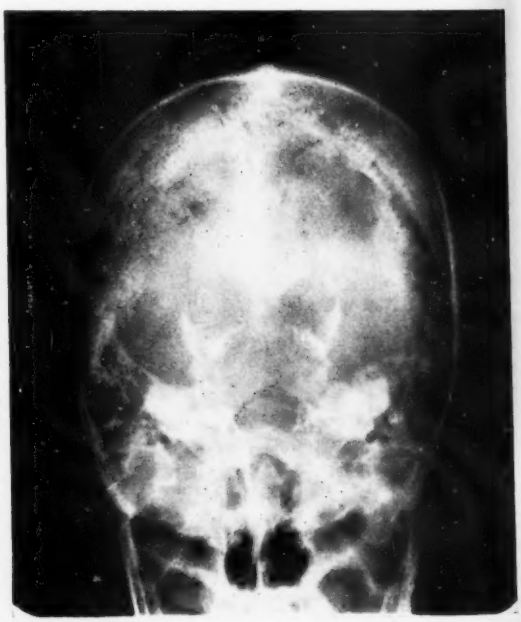

Fig. 3 — Fronto-occipital view of the same skull shows the pineal gland, calcified dentate nuclei and lenticular complexes.

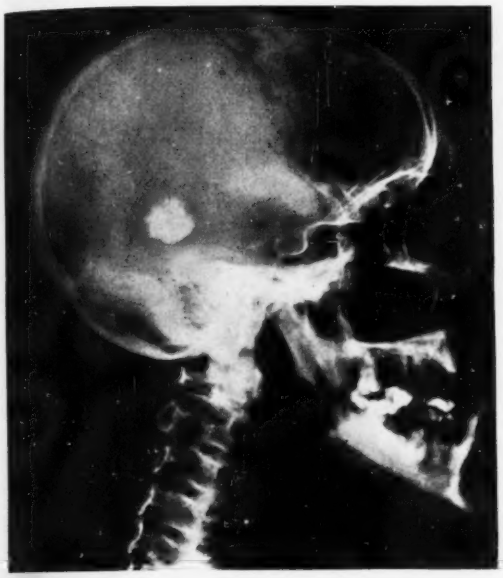

Fig. 4 — Calcified choroid plexuses.

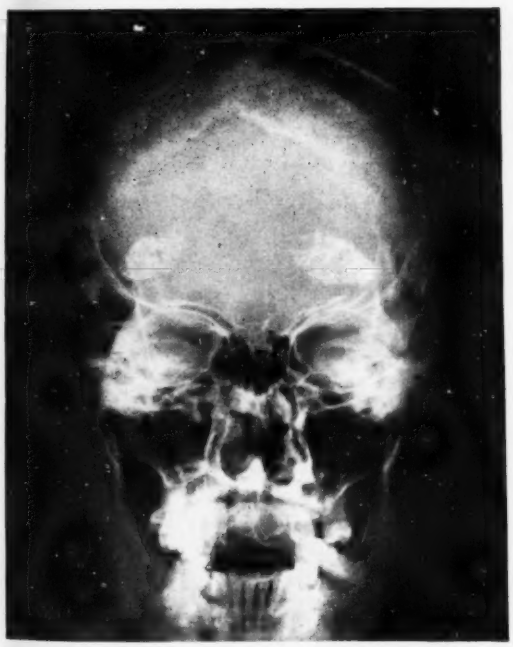

Fig. 5 — Calcified choroid plexuses.

For the purpose of topographical differentiation a case of unusually well demonstrated calcification of the choroid plexus is added. J.A., 38 year-old labourer had been examined at the Ottawa Civic Hospital because of an injury with a suspected fracture of the mandible in July, 1951. The X-ray film of the skull revealed an unusually clear view

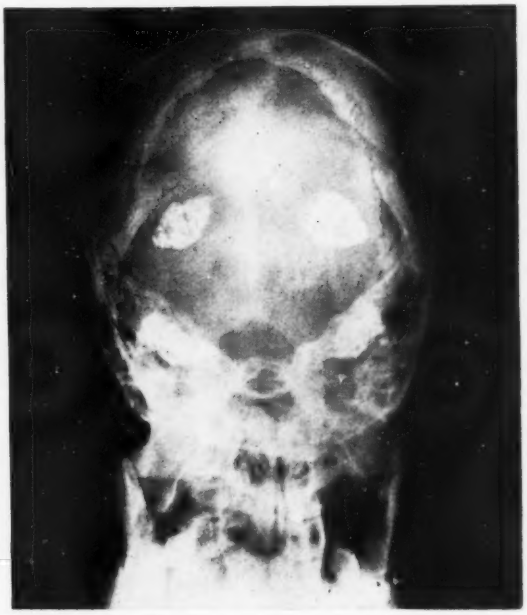

Fig. 6 — Calcified choroid plexuses.

of calcified choroid plexuses, situated symmetrically in the lateral ventricles at the junction of the occipital and temporal horns (Figs. 4, 5, 6). Comparison of these two cases would show the clear topographical difference between these two radiological syndromes of intra-cranial calcifications.

Acknowledgement

Sincere thanks are due to Dr. Donald L. McRae for assistance and guidance in preparing this paper and to Dr. Alan Douglas for lending a manuscript of his paper. Dr. D. W. Cockburn has kindly provided the case of the calcified choroid plexuses from the collection of the Ottawa Civic Hospital. Dr. Converry, Senior Treatment Medical Officer of the Department of Veterans Affairs, Ottawa, kindly consented to our presentation of this case. Drs. R. J. Patterson and D. S. Johnson have earned the author's gratitude for friendly discussion of radiological features of many skull films, including the one presented.

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